HAMEG Instruments

Function Generator HM8030-6

Service-Manual

CE

Hersteller / Manufacturer / Fabricant: HAMEG Instruments GmbH, Industriestraße 6, D-63533 Mainhausen

KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DECLARATION DE CONFORMITE

HAMEG Instruments

Die HAMEG Instruments GmbH bescheinigt die Konformität für das Produkt
The HAMEG Instruments GmbH herewith declares conformity of the product
HAMEG Instruments GmbH déclare la conformite du produit

Bezeichnung / Product name / Designation:
Funktionsgenerator
Function generator
Générateur de fonctions

Typ / Type / Type: **HM8030-6**

mit / with / avec: **HM8001-2**

Optionen / Options / Options:

mit den folgenden Bestimmungen /
with applicable regulations /
avec les directives suivantes

EMV Richtlinie 89/336/EWG ergänzt durch 91/263/EWG, 92/31/EWG
EMC Directive 89/336/EEC amended by 91/263/EWG, 92/31/EEC
Directive EMC 89/336/CEE amendée par 91/263/EWG, 92/31/CEE

Niederspannungsrichtlinie 73/23/EWG ergänzt durch 93/68/EWG
Low-Voltage Equipment Directive 73/23/EEC amended by 93/68/EEC
Directive des equipements basse tension 73/23/CEE amendée par 93/68/CEE

Angewendete harmonisierte Normen /
Harmonized standards applied /
Normes harmonisées utilisées

Sicherheit / Safety / Sécurité:
EN 61010-1: 1993 / IEC (CEI) 1010-1: 1990 A 1: 1992 / VDE 0411: 1994
EN 61010-1/A2: 1995 / IEC 1010-1/A2: 1995 / VDE 0411 Teil 1/A1: 1996-05
Überspannungskategorie / Overvoltage category / Catégorie de surtension: II
Verschmutzungsgrad / Degree of pollution / Degré de pollution: 2

Elektromagnetische Verträglichkeit / Electromagnetic compatibility / Compatibilité électromagnétique

EN 61326-1/A1
Störaussendung / Radiation / Emission: Tabelle / table / tableau 4, Klasse / Class / Classe B.
Störfestigkeit / Immunity / Imunitee: Tabelle / table / tableau A1.

EN 61000-3-2/A14
Oberschwingungsströme / Harmonic current emissions / Émissions de courant harmonique: Klasse / Class / Classe D.

EN 61000-3-3
Spannungsschwankungen u. Flicker / Voltage fluctuations and flicker / Fluctuations de tension et du flicker.

Datum/Date/Date
22.07.2004

Unterschrift / Signature / Signatur

Manuel Roth
Manager

General information regarding the CE marking

HAMEG instruments fulfill the regulations of the EMC directive. The conformity test made by HAMEG is based on the actual generic- and product standards. In cases where different limit values are applicable, HAMEG applies the severer standard. For emission the limits for residential, commercial and light industry are applied. Regarding the immunity (susceptibility) the limits for industrial environment have been used.

The measuring- and data lines of the instrument have much influence on emmission and immunity and therefore on meeting the acceptance limits. For different applications the lines and/or cables used may be different. For measurement operation the following hints and conditions regarding emission and immunity should be observed:

1. Data cables
For the connection between instruments resp. their interfaces and external devices, (computer, printer etc.) sufficiently screened cables must be used. Without a special instruction in the manual for a reduced cable length, the maximum cable length of a dataline must be less than 3 meters and not be used outside buildings. If an interface has several connectors only one connector must have a connection to a cable.
Basically interconnections must have a double screening. For IEEE-bus purposes the double screened cables HZ72S and HZ72L from HAMEG are suitable.

2. Signal cables
Basically test leads for signal interconnection between test point and instrument should be as short as possible. Without instruction in the manual for a shorter length, signal lines must be less than 3 meters and not be used outside buildings.
Signal lines must screened (coaxial cable - RG58/U). A proper ground connection is required. In combination with signal generators double screened cables (RG223/U, RG214/U) must be used.

3. Influence on measuring instruments.
Under the presence of strong high frequency electric or magnetic fields, even with careful setup of the measuring equipment an influence of such signals is unavoidable.
This will not cause damage or put the instrument out of operation. Small deviations of the measuring value (reading) exceeding the instruments specifications may result from such conditions in individual cases.

HAMEG Instruments GmbH

10 MHz Function Generator HM8030-6

Option HO801

HZ33, HZ34
Test cable BNC/BNC

HZ20 Connector
BNC to 4mm socket

- Frequency range 50 mHz to 10 MHz
- High signal purity and amplitude stability
- Distortion factor ‹ 0.5 % up to 1 MHz
- Output voltage 20 V_{pp} (10 V_{pp} into 50 Ω)
- Surge- and short-circuit-proof output
- Rise and fall time typ. 15 ns
- Internal and external sweep
- Pulse width adjustment
- Highly accurate digital frequency display
- Mainframe HM8001-2 required for operation

10 MHz Function Generator HM8030-6

Valid at 23 °C after a 30 minute warm-up period

Operating modes

Sine, square, triangle, pulse; free running, internal sweep or external frequency modulation, with or without DC offset

Frequency ranges

0.05 Hz to 10 MHz in 8 ranges, variable: x 0.09 to x 1.1 (12:1)

Frequency drift:	‹ 0.5 % / hr or 0.8 %/24 hrs. at constant ambient temperature

Waveform characteristics

Sine wave distortion	
0.05 Hz to 1 MHz:	max. 0.5 %
1 MHz to 10 MHz:	max. 5 %
Square wave rise time:	typ. 15 ns
Overshoot:	‹ 5 % (for termination into 50 Ω)
Triangle non-linearity:	‹ 1 % (to 100 kHz)

Displays

Frequency:	5-digit, 7-segment LED, each 8 x 5 mm
Accuracy:	
up to 5 Hz:	± (1 % + 3 digits)
5 Hz to 10 MHz:	± (5×10^{-5} + 1 digit)

LED indicators for mHz, Hz, kHz and sec

Outputs

Signal output:	short-circuit proof,
protected against ext. voltage	up to ± 45 V_{DC} max. (30 sec.)
Impedance:	50 Ω
Output voltage:	10 V_{pp} into 50 Ω load; 20 V_{pp} (open circuit)
Attenuation:	max. 60 dB
2 attenuators:	each 20 dB ± 0.2 dB
Variable:	0 to 20 dB
Amplitude error:	(sine wave/triangle)
0.05 Hz to 0.5 MHz:	max. 0.2 dB
0.5 MHz to 10 MHz:	max. 0.5 dB
DC offset:	variable (on/off, except pulse function)
into 50 Ω load:	max. ±2.5 V
in open circuit:	max. ±5 V
Trigger output:	square wave synchronous to signal output, approx. +5 V/TTL

FM input

(VCF, BNC connector on rear panel of HM8001-2 and option HO801)

Frequency deviation:	approx. 1 : 100
Input impedance:	6 kΩ II 25 pF
Input voltage:	max. ± 30 V

Internal sweep

Sweep speed:	20 ms to 15 s
Sweep range:	approx. 1:100

Miscellaneous

Power supply (from mainframe):	+ 5 V/200 mA + 16 V/300 mA - 16 V/250 mA (∑= 9.8 W).
Operating temperature:	+10° C to + 40° C
Max. relative humidity:	80 % (without condensation)
Dimensions (W x H x D) (without 22-pole flat plug):	135 x 68 x 228 mm
Weight:	approx. 0.80 kg

Accessories supplied: Operator's Manual
Optional accessories: HZ33/HZ34 BNC Test Cable, HZ22 50 Ω feed-through terminal, HZ10 Silicone test leads

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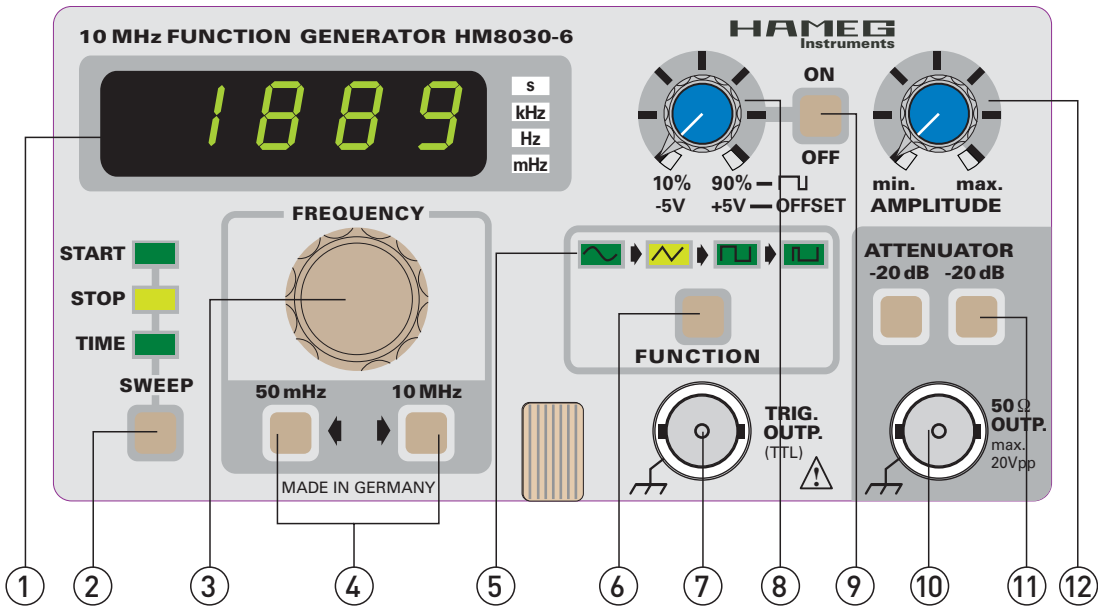


Control elements

① **DISPLAY (7 segment LED)**
5-digit frequency meter. LED indicators for mHz, Hz, kHz and s

② **SWEEP (push button) and SWEEP- Indication (LEDs)**
Button activates internal sweep generator. The LEDs indicate the function chosen with the SWEEP-Button. Settings are changed with ③ or ④.

③ **FREQUENCY (adjustment knob)**
Continuous and linear frequency fine ad-justment, with the setting range from 0.09 to 1.1 (approx 0.045 to 1.1 in 10 MHz-range) overlapping the ranges selected with ④

④ **FREQUENCY (2 pushbuttons)**
Frequency range selection from 50 mHz to 10 MHz in 8 decade steps.

⑤ ∿ ⋀ ⊓ ⊔ – **(LED s)**
Indication of selected function.

⑥ **FUNCTION – (pushbutton)**
Mode selection: Triangle, Sine, Square, Pulse and Off.

⑦ **TRIGGER OUTPUT (BNC connector)**
This short-circuit-proof output supplies a square signal in synchronism with the output signal. It is TTL compatible and has a duty-factor of approx. 50%.

⑧ **OFFSET (adjustment knob)**
Adjustment of the positive or negative offset voltage. This DC voltage can be super-imposed on the output signal. The max. offset voltage is ±5V (o.c.) or ±2.5V respectively when terminated into 50Ω. The offset voltage is available to all functions except for pulse and activated by ⑨. In operation mode OFF (no function activated) it can be used separatey. In pulse mode the pulse width is set with this control from 10% to 90%.

⑨ **ON (pushbutton)**
Activates the offset function except in pulse mode. If the ON-button is pushed in pulse mode, pulse width is set with the control ⑧ from 10% to 90%. In OFF-position the fixed pulse width amounts to 50%.

⑩ **50Ω OUTPUT (BNC connector)**
Short-circuit proof signal output of the generator. The output impedance is 50Ω and the max. output amplitude is 20V_{pp} (o.c.) or 10V_{pp} respectively when terminated into 50Ω.

⑪ **–20dB, –20bB (pushbutton)**
Two fixed attenuators, 20dB each. They can be used separately. When both pushbuttons are activated, a total attenuation of 40dB results. Including the amplitude control ⑫, the max. attenuation amounts to 60dB (factor 1000).

⑫ **AMPLITUDE (adjustment knob)**
Continuous adjustment of the output ampli-tude from 0 to –20dB terminated into 50Ω.

Adjustment

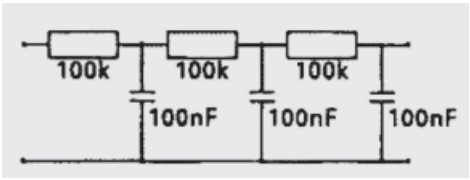
Please observe the correct sequence of steps!

Measuring equipment required:
- Digital Multimeter (HM8012 or similar)
- Frequency counter (HM8021 or similar)
- Distortion meter (HM8027 or similar)
- Oscilloscope (HM1507 or similar)

1) Turning service mode on
a) For activating service mode push both buttons „50mHz" and „10MHz" simultaneously and switch on the HM8030.
b) If the EPROM is empty or if the HM8030 is new, the display will show „E", otherwise „F 3.1". Push button „FUNCTION".
c) If the display shows „XXX3" (X = any figure, figure ‚3' blinking), turn off the instrument.

2) Switches and controls
These settings must be kept constant during the whole adjustment procedure!
a) Open the top cover of the instrument.
b) Set OFFSET control to center position.
c) Button OFFSET deactivated.
d) Set AMPLITUDE control the right stop.
e) Buttons ATTENUATOR deactivated.
f) Push button SWEEP as often as needed to extinguish the START, STOP and TIME LEDs.

3) Internal triangle generator



a) Set HM8030 to triangle function with f = 5250 Hz.
b) Connect HM8012 (measuring range: 500 mV_{DC}) with a probe (with the low pass filter shown) at PT100.
c) Adjust 0 mV ±1 mV with VR103.
d) Connect HM8012 (measuring range: 500 mV_{AC}) with a probe (without low pass filter) at PT100.
e) Adjust 577,3 mV ±1 mV with VR102.
f) As the settings are interacting, repeat steps b) to e) as often as is necessary for an optimum result.

4) Duty cycle 1
a) Connect HM8021 (function: pulse) to OUT.
b) Set HM8030 to square function with f = 52,50 kHz.
c) Adjust VR101 so that the positive pulse width is equal to the negative pulse width.
d) Set HM8030 to square function with f = 4,75 kHz .
e) Adjust VR104 so that the positive pulse width is equal to the negative pulse width.
f) As the settings are interacting, repeat steps b) to e) as often as is necessary for an optimum result.

5) Duty cycle 2
a) Connect HM8021 (function: pulse) to OUT.
b) Set HM8030 to square function with f = 475 Hz.
c) Adjust VR106 so that the positive pulse width is equal to the negative pulse width.

6) OUTPUT Offset
a) Connect HM8012 (measuring range: 500 mV_{DC}) with low pass filter to OUT.
b) Set HM8030 to triangle function with f = 5250 Hz.
c) Adjust 0 mV ±1 mV with VR111.

7) Distortion
a) Connect HM8027 (20k Frequency Range) to OUT.
b) Set HM8030 to sine function with f = 5250 Hz.
c) Set HM8027 (settings: 100% CAL) with the blue control to 100, than switch to 10%.
d) Adjust the distortion factor to less than 0.3% by alternately adjusting VR108 and VR109.
e) If this adjustment is not possible, return to step 4) because the duty cycle was not correctly adjusted.

8) Square 1
a) Connect oscilloscope HM1507 (settings: 1V/div, 100µs/div) with 50Ω to OUT.
b) Set HM8030 to triangle function with f = 5250 Hz.
c) Adjust VAR on the oscilloscope so that the amplitude of the signal equals to 6 div.
d) Set HM8030 to square function with f = 5250 Hz.
e) Adjust VR105, VR107 and VR110 so that the amplitude of the square signal amounts to 6 div.
f) Repeat step e) with f = 52,5 kHz.

9) Square 2
a) Connect oscilloscope HM1507 (settings: 1V/div, 50ns/div) with a 50Ω load at OUT.
b) Set HM8030 to square function with f = 5250kHz.
c) Adjust VC102 and VC104 so that the amplitude of the square signal equals to 6 div.

10) Triangle
a) Connect oscilloscope HM1507 (settings: 1V/div, 50ns/div) with a 50Ω load at OUT.
b) Set HM8030 to triangle function with f = 7000 kHz.
c) Adjust VC101 so that the amplitude of the triangle signal equals to 6 div.

11) Duty cycle of pulse
a) Connect HM8021 (function: pulse) to OUT.
b) Set HM8030 to pulse function with f = 5250 Hz.
c) Adjust VR1 so that the positive pulse width is equal to the negative pulse width.

Adjustment HM8030-6

30. November 2004

1) Turning service mode on

a) For activating service mode push both buttons „50mHz“ and „10MHz“ simultaneously and switch on the HM8030.

a) If the EPROM is empty or if the HM8030 is new, the display will show „E“, otherwise „F 3.1“. Push button „FUNCTION“. If the display shows „XXX3“ (X = any figure, figure ‚3’ blinking), turn off the instrument.

2) Switches and controls - These settings must be kept constant during the whole adjustment!

a) Open the top cover of the instrument.
b) Set OFFSET control to center position.
c) Button OFFSET deactivated.
d) Set AMPLITUDE control to the right stop.
e) Buttons ATTENUATOR deactivated.
f) Push button SWEEP as often as is needed to extinguish the START, STOP and TIME LEDs.

10) Triangle

a) Connect oscilloscope HM1507 (settings: 1V/div, 50ns/div) with a 50Ω load at OUT.
b) HM8030 - traingle function - f = 7000kHz.
c) Adjust VC101 so that the amplitude of the triangle signal equals to 6 div.

4) Duty cycle 1

a) Connect HM8021 (function: pulse) to OUT.
b) HM8030 - square function - f = 52,50kHz.
c) Adjust VR101⇒ the pos. pulse width is equal to neg. pulse width.
d) HM8030 - square function - f = 4,75kHz .
e) Adjust VR104 so that the positive pulse width is equa to the negative pulse width.
f) As the settings are interacting, repeat steps b) to e)

5) Duty cycle 2

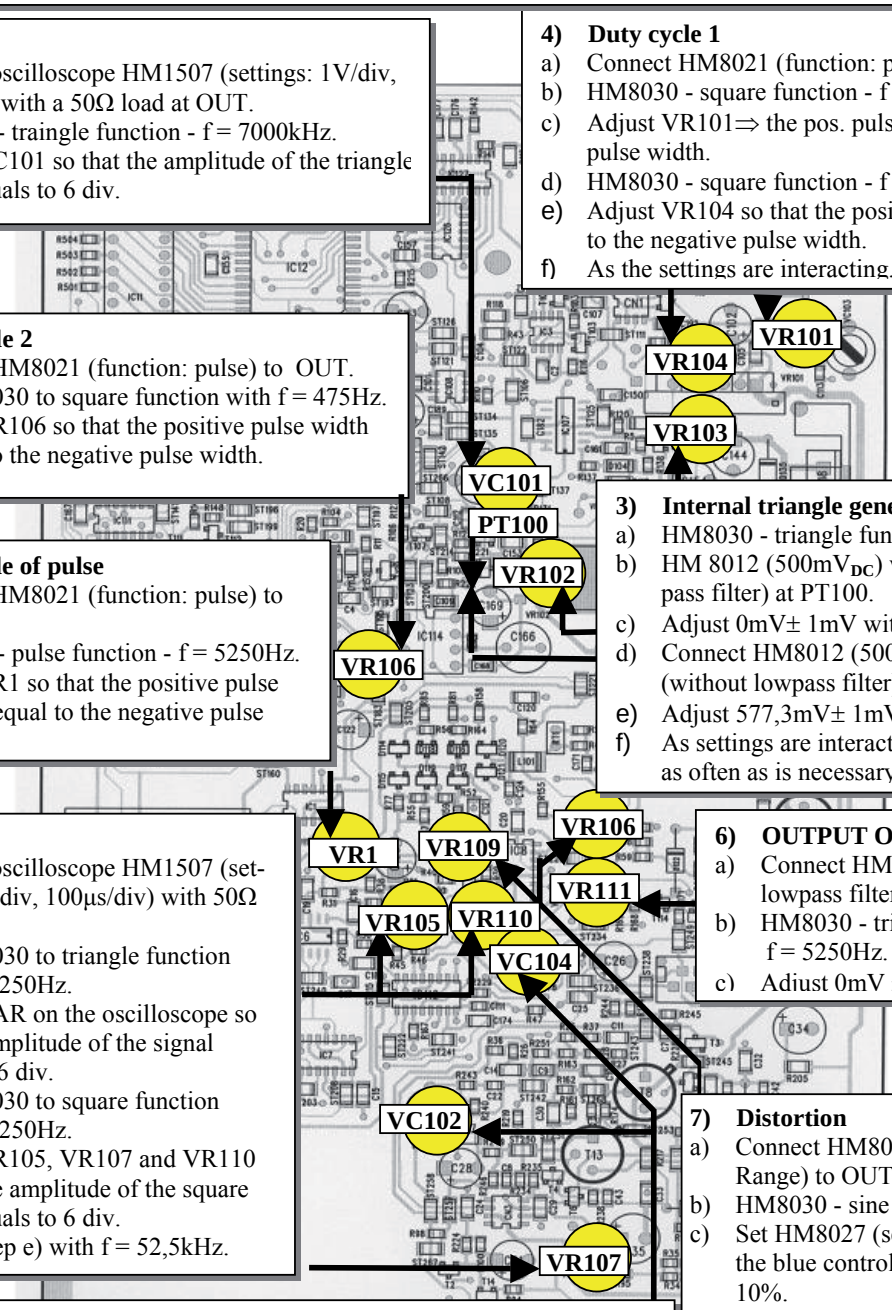
a) Connect HM8021 (function: pulse) to OUT.
b) Set HM8030 to square function with f = 475Hz.
c) Adjust VR106 so that the positive pulse width is equal to the negative pulse width.

3) Internal triangle generator

a) HM8030 - triangle function - f = 5250Hz.
b) HM 8012 (500mV$_{DC}$) with a probe (with low-pass filter) at PT100.
c) Adjust 0mV± 1mV with VR103.
d) Connect HM8012 (500mV$_{AC}$) with a probe (without lowpass filter) at PT100.
e) Adjust 577,3mV± 1mV with VR102.
f) As settings are interacting, repeat steps b) - e) as often as is necessary for an optimum result.

11) Duty cycle of pulse

a) Connect HM8021 (function: pulse) to OUT.
b) HM8030 - pulse function - f = 5250Hz.
c) Adjust VR1 so that the positive pulse width is equal to the negative pulse width.



8) Square 1

a) Connect oscilloscope HM1507 (settings: 1V/div, 100µs/div) with 50Ω to OUT.
b) Set HM8030 to triangle function with f = 5250Hz.
c) Adjust VAR on the oscilloscope so that the amplitude of the signal equals to 6 div.
d) Set HM8030 to square function with f = 5250Hz.
e) Adjust VR105, VR107 and VR110 so that the amplitude of the square signal equals to 6 div.
f) Repeat step e) with f = 52,5kHz.

6) OUTPUT Offset

a) Connect HM8012 (500mV$_{DC}$) with lowpass filter to OUT.
b) HM8030 - triangle function - f = 5250Hz.
c) Adiust 0mV ± 1mV with VR111.

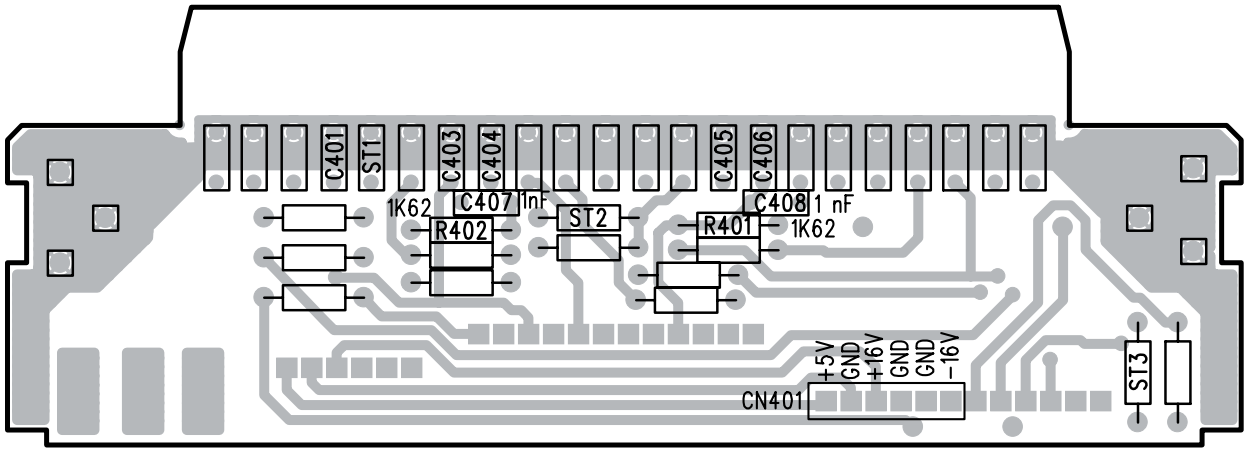
9) Square 2

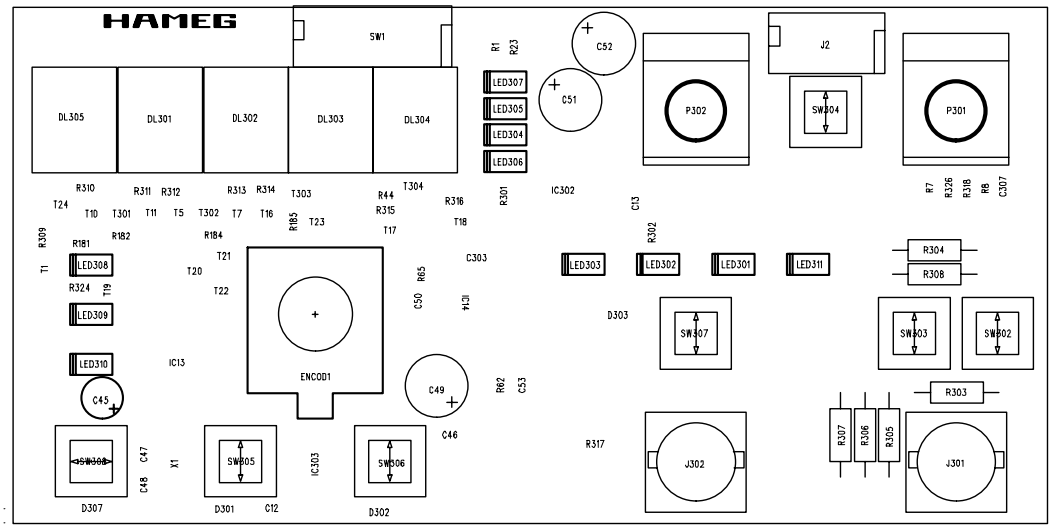
a) Connect oscilloscope HM1507 (settings: 1V/div, 50ns/div) with a 50Ω load at OUT.
b) Set HM8030 to square function with f = 5250kHz.
c) Adjust VC102 and VC104 so that the amplitude of the square signal equals to 6 div.

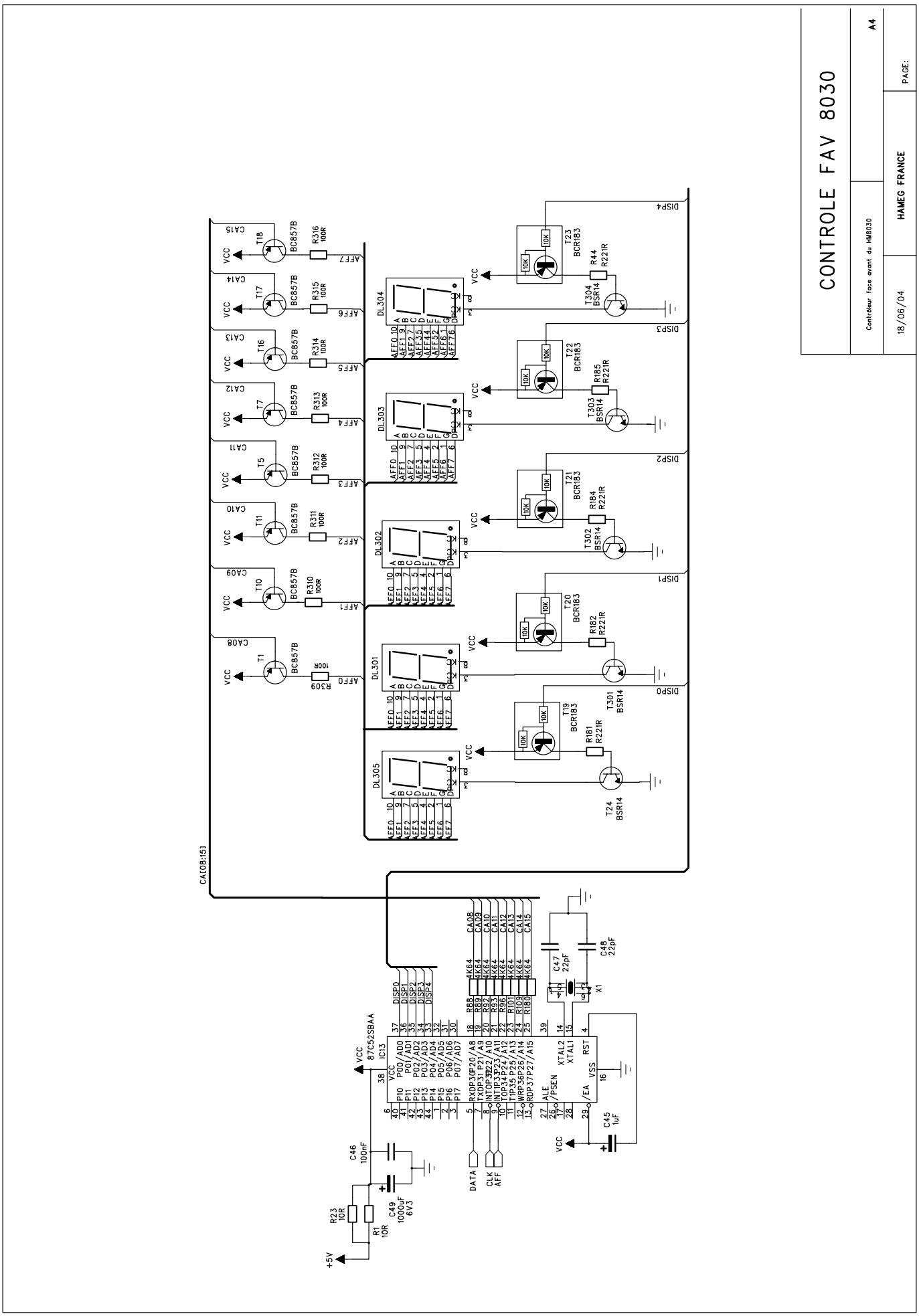
7) Distortion

a) Connect HM8027 (20k Frequency Range) to OUT.
b) HM8030 - sine function - f = 5250Hz.
c) Set HM8027 (settings: 100% CAL) with the blue control to 100, than switch to 10%.
d) Adjust the distortion factor to less than 0.3% by alternately adjusting VR108 and VR109.
e) If this adjustment is not possible, return to step 4) because the duty cycle was not correctly adjusted.

COTE COMPOSANT






CONTROLE FAV 8030
Contrôleur face avant du HM8030
HAMEG FRANCE
18/06/04
A4
PAGE:
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DISP0
DISP1
DISP2
DISP3
DISP4
DL301
DL302
DL303
DL304
DL305
T1
T10
T11
T5
T7
T16
T17
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T19
T20
T21
T22
T23
T24
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T302
T303
T304
BC857B
BSR14
BCR183
R309
R310
R311
R312
R313
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R316
R181
R182
R184
R185
R44
R221R
100R
10K
IC13
87C52SBAA
C45
1uF
C46
100nF
C47
22pF
C48
22pF
C49
1000uF
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10R
R23
10R
X1
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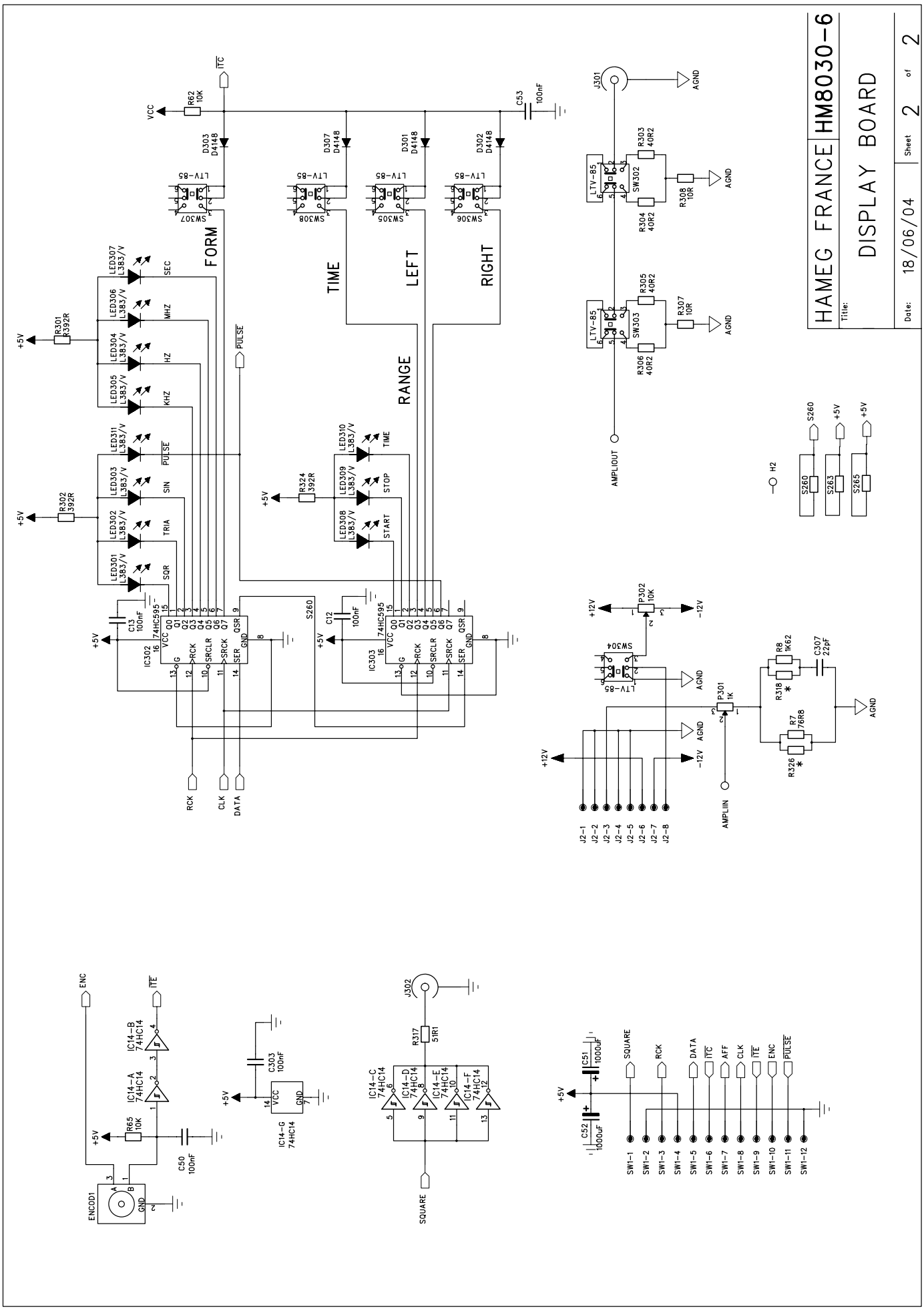
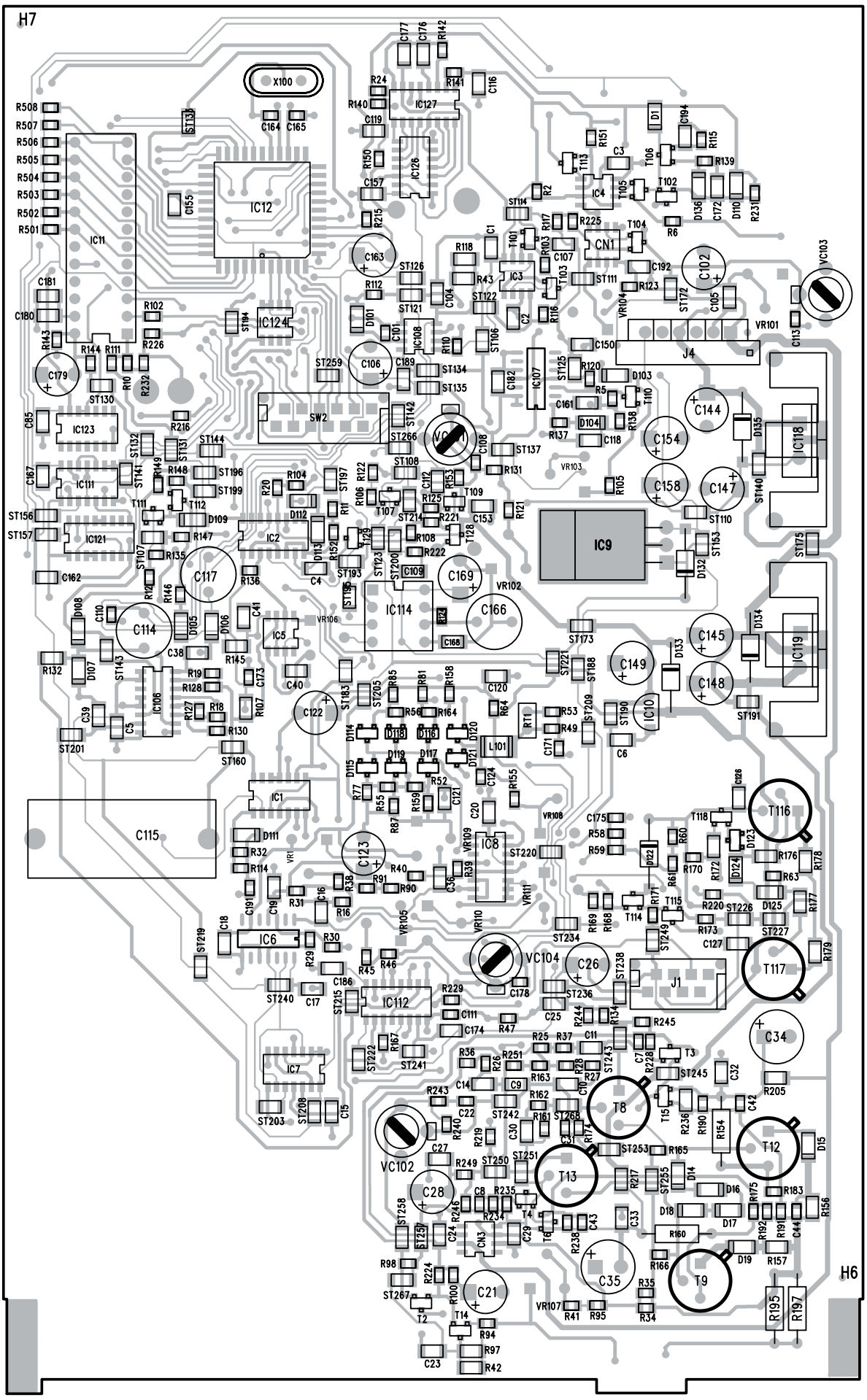
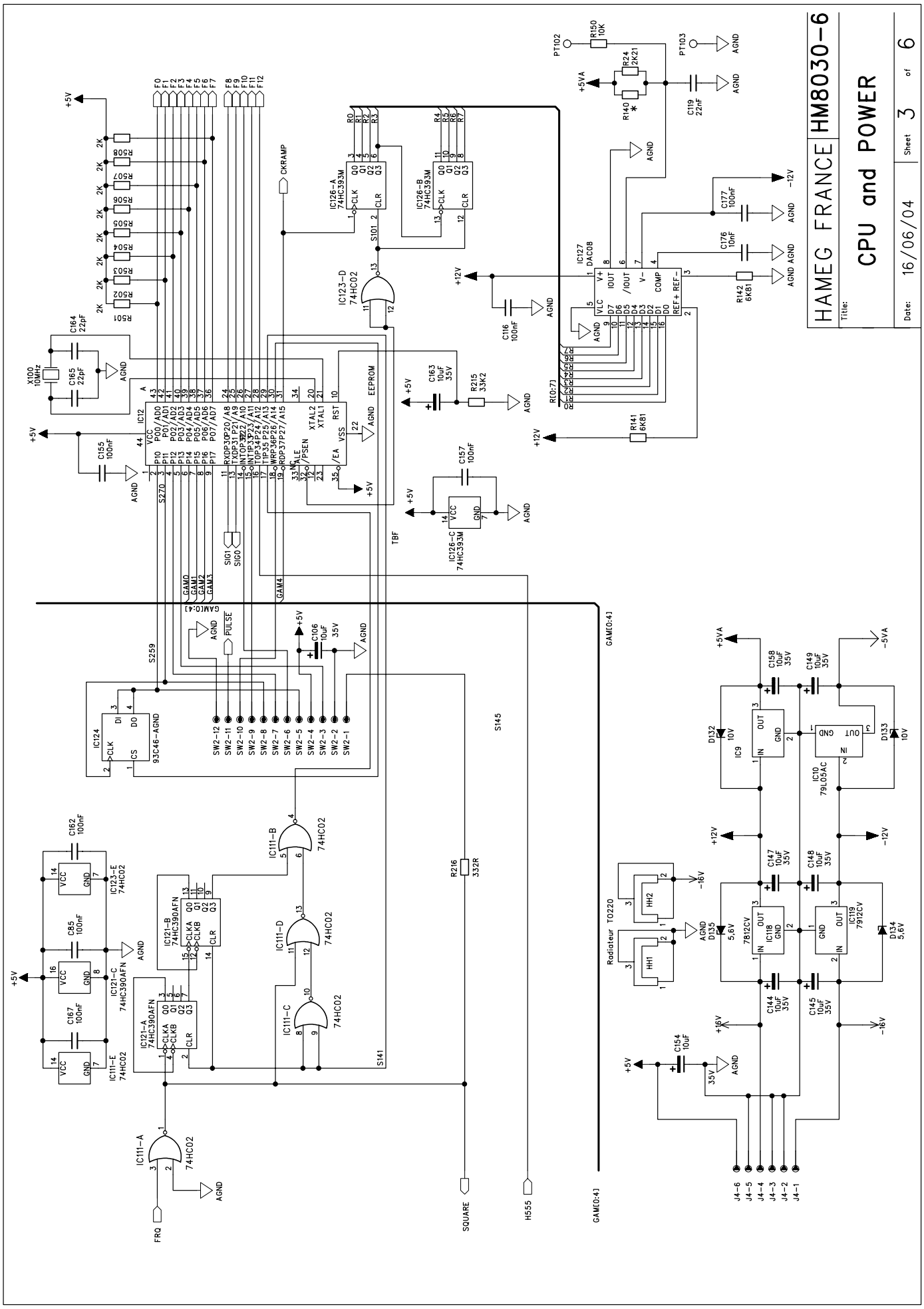
VCC
DATA
CLK
AFF


HAMEG FRANCE HM8030-6
Title: DISPLAY BOARD
Date: 18/06/04
Sheet 2 of 2
FORM
TIME
LEFT
RIGHT
RANGE
PULSE
SEC
MHZ
HZ
KHZ
SIN
TRIA
SQR
TIME
STOP
START
RCK
CLK
DATA
AMPLIOUT
AMPLIIN
SQUARE
ENC
ITC
ITE
AFF
PULSE
AGND
+5V
+12V
-12V

HM8030-6 M/D – IMPLANTATION COTE COMPOSANTS

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Date: 16/06/04
Sheet 3 of 6
IC12
IC124
IC126-A 74HC393M
IC126-B 74HC393M
IC126-C 74HC393M
IC127 DAC08
IC123-D 74HCO2
IC111-A 74HCO2
IC111-B 74HCO2
IC111-C 74HCO2
IC111-D 74HCO2
IC111-E 74HCO2
IC121-A 74HC390AFN
IC121-B 74HC390AFN
IC121-C 74HC390AFN
IC123-E 74HCO2
IC9
IC10 79L05AC
IC118 7812CV
IC119 7912CV
93C46-AGND
EEPROM
Radiateur TO220
CKRAMP
PULSE
SQUARE
H555
FRQ
TBF
GAM[0:4]
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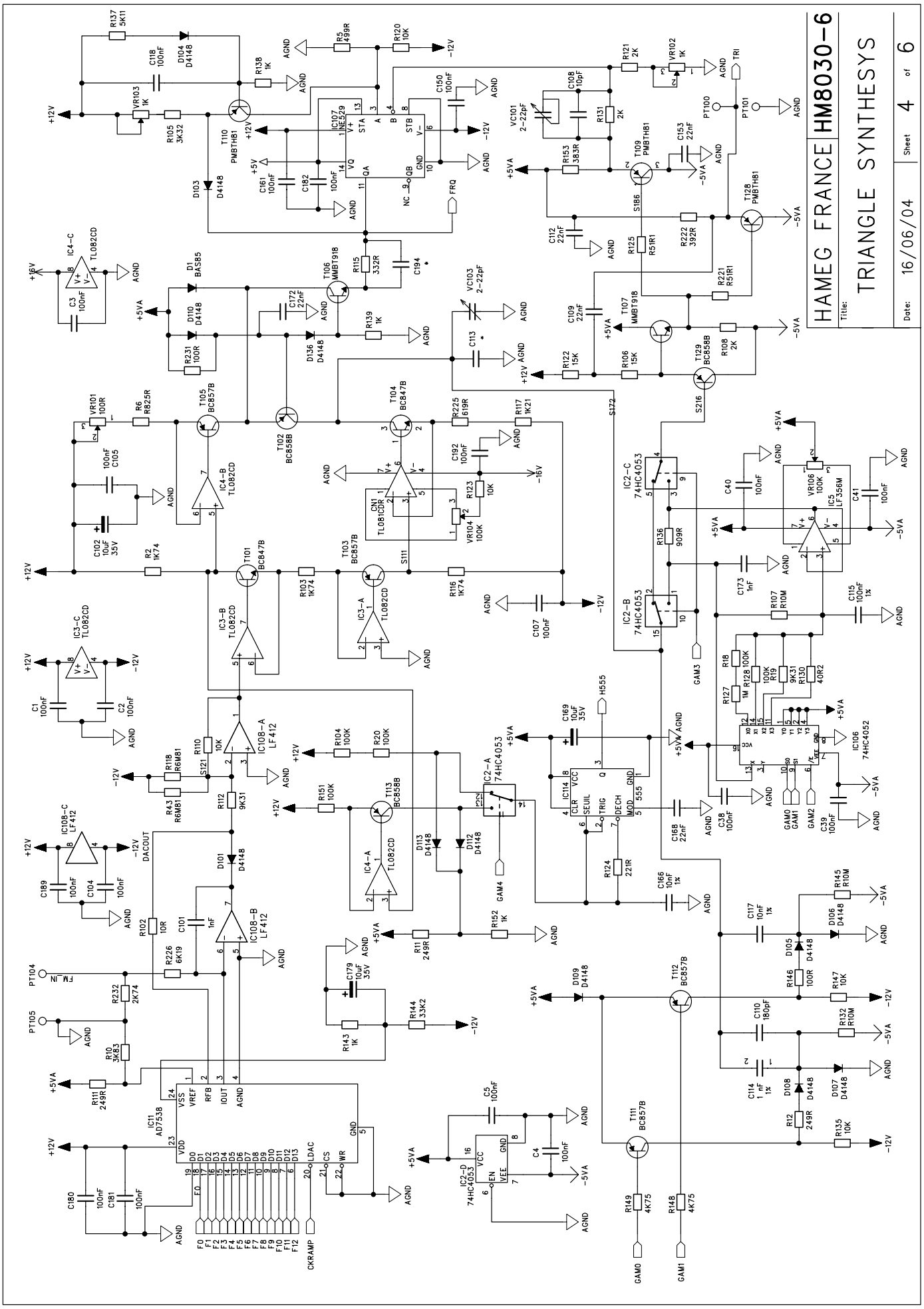
-5V
+5VA
+12V
-12V
+16V
-16V
AGND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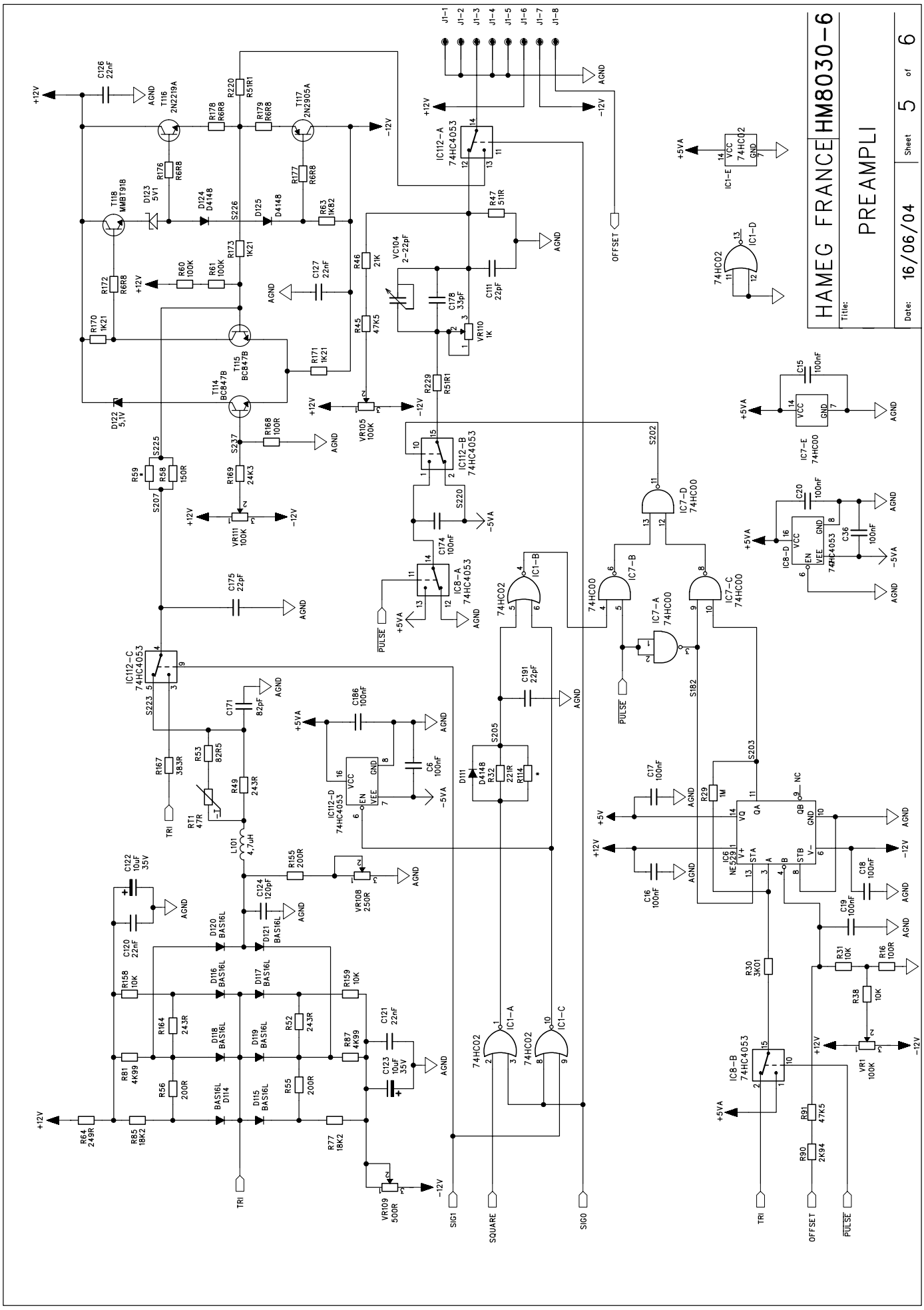
TRIANGLE SYNTHESYS
Date: 16/06/04
Sheet 4 of 6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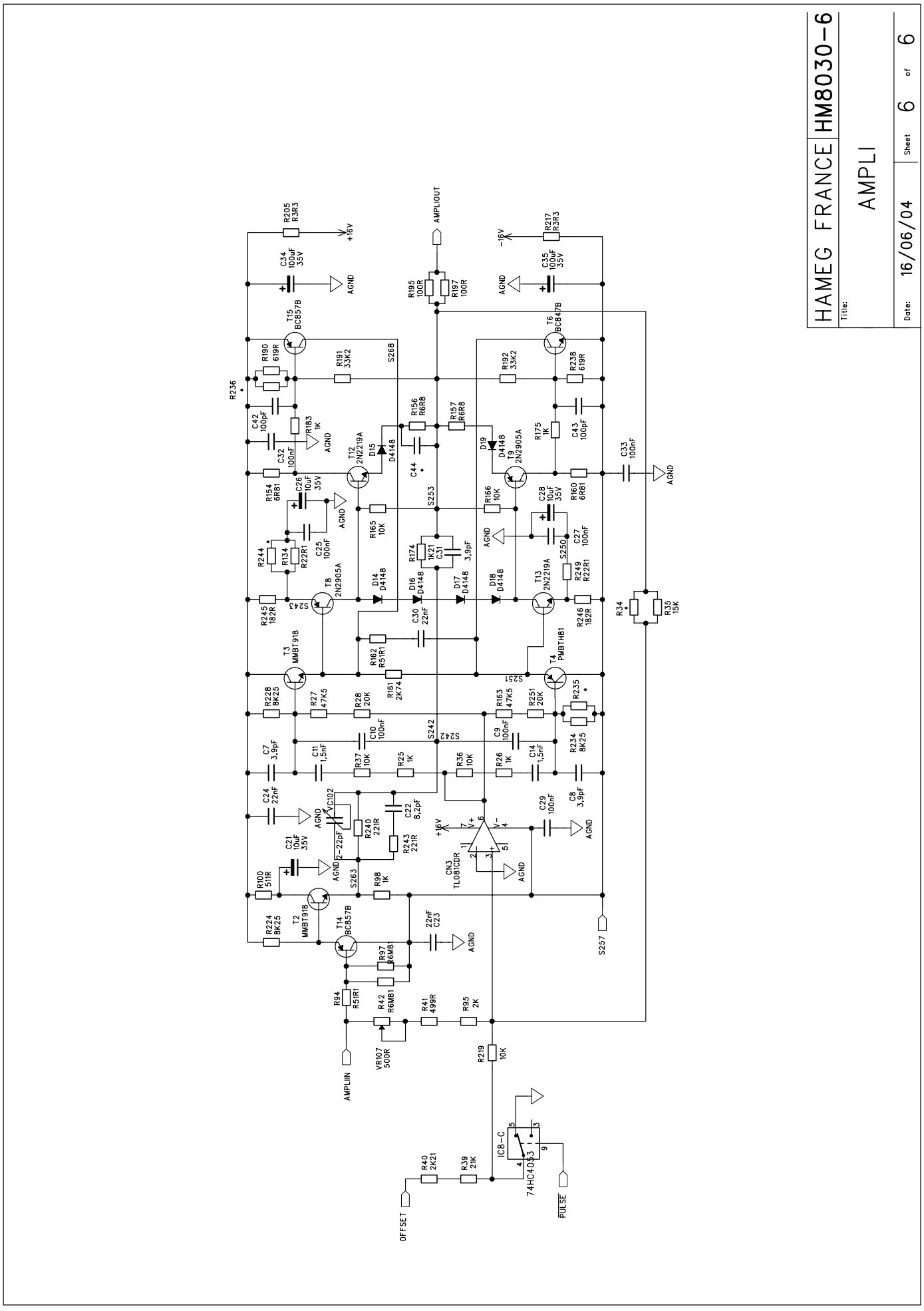
Title: PREAMPLI
Date: 16/06/04
Sheet 5 of 6
+12V
-12V
+5V
-5V
+5VA
AGND
OFFSET
PULSE
SQUARE
SIG1
SIG0
TRI
74HCO2
74HC00
74HC4053
NE529


HAMEG FRANCE HM8030-6
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Date: 16/06/04
Sheet 6 of 6
AMPLIOUT
AMPLIIN
OFFSET
PULSE
+16V
-16V
AGND
R205 R3R3
R217 R3R3
C34 100uF 35V
C35 100uF 35V
R195 100R
R197 100R
T15 BC857B
T6 BC847B
R190 619R
R191 33K2
R192 3K2
R238 619R
R236 *
C42 100pF
R183 1K
C32 100nF
T12 2N2219A
D15 D4148
R156 R6R8
R157 R6R8
D19 D4148
T9 2N2905A
R175 1K
C43 100pF
C33 100nF
R154 6R81
C26 10uF 35V
R160 6R81
C28 10uF 35V
R166 10K
R165 10K
C25 100nF
C27 100nF
R244 *
R134 R22R1
R174 1K21
C31 3,9pF
S250
R249 R22R1
T8 2N2905A
D14 D4148
D16 D4148
D17 D4148
D18 D4148
T13 2N2219A
R245 182R
R246 182R
R34 *
R35 15K
C30 22nF
T3 MMBT918
T4 PMBTH81
R162 R51R1
R161 2K74
R228 8K25
R27 47K5
R28 20K
R163 47K5
R251 20K
R235 *
C10 100nF
C9 100nF
R234 8K25
C7 3,9pF
C11 1,5nF
R37 10K
R25 1K
R36 10K
R26 1K
C14 1,5nF
C24 22nF
VC102 2-22pF
C22 8,2pF
R240 221R
R243 221R
C29 100nF
C8 3,9pF
C21 10uF 35V
CN3 TL081CDR
R100 511R
R98 1K
T2 MMBT918
T14 BC857B
R224 8K25
22nF C23
R97 R6MB1
R94 R51R1
R42 R6MB1
R41 499R
R95 2K
VR107 500R
R219 10K
IC8-C 74HC4053
R40 2K21
R39 21K
S243
S253
S242
S251
S263
S268
S257

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